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Views on Water Resources and Urban Planning in the Transition Economies

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Introduction

Fifteen years after the transition period for the Russian Federation, it is time to examine what effect the economic transition has had on urban environmental conditions in the transition economy countries. (Honneland 2003) Cities were the industrial, managerial, and economic showcases of the centrally planned economies. From an environmental point of view, they also left much to be desired. Despite significant investment in water treatment plants and delivery infrastructure, water remains far from potable in major cities of the transition economies. (Danilov-Danilyan 1998; Kimstach 1998; Zhulidov 2000) In many cases, surface waters adjacent to those cities remain heavily polluted. The transition economies provide an unparalleled opportunity to examine the environmental effects of an abrupt and sustained reduction in industrial water pollution. The economic collapse of the transition economies in the 1990s was accompanied by a sharp reduction in industrial effluents, only sporadic investment in wastewater treatment infrastructure, and a slow but gradual increase in consumer demand. The transition period is also an opportunity to examine the effects of new institutional approaches to environmental protection during the same period.

One of the realities of the period has been the extraordinary pace of change. Inflation, institutional re-organization, legislative change, and the loss of specialized personnel has been an on-going challenge for improvements in the environment and environmental protection during the transition period. Residents of the transition economies have seen more change in less than two decades than residents of other economies see in a lifetime. That change has not been more rapid than in the largest cities of the transition economies. Improvements in the environment during the transition period have largely been prescribed to a collapse in industrial production. Yet that is only one aspect of a wide range of socio-economic, structural, and institutional changes that have taken place during the period as concerns the environment.

This study examines the linkages between changes in water quality in the urban environment of one of the largest transition economies, that of the Russian Federation, and the economic and social changes of the transition period. This study's central question is the following: how and to what extent have the economic, social, and institutional developments of the transition period had an impact on the quality and management of water resources of a major urban center in a transition economy? Our investigation focuses on the impact of economic transition on the management of industrial effluent and other wastewater and runoff sources in the urban environment of St. Petersburg. This study examines quality changes in surface water during the 1990s in the St. Petersburg region relative to economic change, with a parallel analysis of changes in residential water use, in the infrastructure of water delivery, and in institutional setting. Water resources are critical to the St. Petersburg region in terms of population health, economic development, transportation channels, recreation, food sources, and international relations. It is the more specific task of this study to examine the extent to which changes in water quality may have resulted as a result of such passive factors as industrial decline, or active factors such as changes in wastewater treatment plant improvements or other improvements in environmental practices. This study seeks to decompose the sources and drivers of trends in water pollution during the transition period. While a direct comparison with other regions will not be undertaken, it is implicit that lessons learned from St. Petersburg may be applicable in the context of other cities of the transition economies.

Evolution from Soviet to post-Soviet views on water resources

Russian and Western evaluations of the condition of water resources during the transition period have faced many of the same challenges that evaluations of the environment during the Soviet period faced. One of the most basic challenges has remained access to monitoring data. Disclosure to the public usually takes place in the form of highly aggregated data for annual reports. Those reports are published with very small

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press runs (for the city of St. Petersburg, a city of 4.6 million, the city's annual environmental report is printed in a 1000-copy press run and is not available electronically) and are distributed almost among government officials and a very small number of libraries. Government monitoring agencies and research institutes have also not been forthcoming in providing their data to either other researchers without significant financial outlays. Those restrictions appear to be more financially motivated than based on government restrictions. As concerns public perceptions of water waste, it is regularly reported to be the most significant environmental threat in Russia. "According to a 1990 government survey of 10,000 citizens living in ecologically depressed regions, water pollution was the problem that troubled people the most." (Peterson 1993) As with capital flight, it is difficult to dispute the wisdom of inside users.

Soviet and now Russian studies on water quality have of course made large advances in publishing their research since the Soviet period. The opportunity to publish abroad has resulted in a number of significant articles on water quality in the Russian Federation in peer-reviewed Western journals, including one entire journal issue devoted to Russian water research. This situation is quite different than that prior to the collapse of the Soviet Union. "Prior to the 1990s, most scientists (Russian or otherwise) were unable to access, analyse, or publish official water quality data of the former Soviet Union." (Zhulidov 2000) The absence of a tradition of publishing literature outside of Russia, and therefore in the English language, has been an on-going challenge.

There has been a bifurcation in the study of water resources in Russia. Russian water hydrologists are among the world's leaders in calculating global flows and volumes. Indeed, Shiklomanov's *World Water Resources at the Beginning of the 21st Century* is currently recognized as one of the best recent contributions to world water flows and consumption cycles. The Russians' estimates of the role of Siberian rivers in the global hydrology cycle is well-recognized. Wolfson highlighted both the advances of Soviet research but also the threat it faced of falling behind that of other countries. "A famous expert once concluded a talk, 'The Americans set about preserving nature with purely American seriousness. They have already caught up with us in many respects, and I will not be surprised if in ecology as well, they soon, figuratively speaking, will be walking on the moon. And we will look up at them from below and write that nonetheless we were first ….'" (Wolfson 1978) Komarov's prediction would appear to have been come largely true.

As a result, in comparison with Western researchers, Russian researchers' work on water resources represents only a very poor percentage of space in the published literature. As mentioned above, data sets are still closely guarded resources that collecting agents keep largely closed to outsiders, whether Russian or foreign. One of the reasons for such closely guarded data is the perception that those data represent a large capital that can be transformed into very large research grants or outright sales if the right buyer (presumably Western) can be identified. "While such restrictions no longer exist, much of the data remain inaccessible." (Zhulidov 2000) The use of water and its management in the Soviet Union of course has had a long history of being far outside the purview of an average citizen. Beyond the general atmosphere of secrecy during the Soviet period, Wolfson adds a second explanation. Wolfson's reasoning is not based on military restrictions, but instead on material poverty as concerns collection equipment. "There is a widely held view that all information on water is kept secret in our country," explains Wolfson. (Wolfson 1994) He continues by citing a water purveyor in Moscow: "Alexander Lopatin, Chief Supervisor of Moscow water supplies, explained that there are no secrets concerning water – not because there is no mystery, but rather because there is nothing to make a mystery out of: 'There are no data, because there is a shortage of equipment, techniques, chemicals, and, of course, hard currency with which all of those things could be purchased abroad.'" (Wolfson 1994) Koronkevich has confirmed this opinion more recently about equipment for measuring being largely absent. As a result only a small number of water bodies are studied in detail: "… accurate data about the actual size of pollution of natural water bodies by the whole spectrum of contaminants are largely absent, and data on the presence of pesticides, synthetic organic compounds, and dioxins exist for only a limited number of water bodies." (Koronkevich 2003) To that we might add the challenge of paying salaries to researchers, and the general decline in scientific research budgets during the post-Soviet period.

Despite the paucity of public disclosure of water quality during the Soviet and post-Soviet periods, certain trends in water resource and quality emerge about which there is general consensus. In the 1960s the continued growth of industry brought further demands on water use in the Soviet Union. In brief, the following principles applied to water use in the Soviet Union: 1) a perception of water resources having no limits to their amount 2) the use of water was to be free-of-charge 3) a single approach to water use throughout the country, with no attention to local supplies or conditions. (Koronkevich 2003) And as Shiklomanov concludes, “the rapid rise in water use by industry is one of the main causes of the growth of water pollution.” (Shiklomanov 2003) He attributes much of that industrial pressure on water pollution to rapid growth in electricity consumption. “During the past two to three decades, industrial water use has risen sharply, largely because electric power production has grown. (Shiklomanov 2003) Those very large industrial needs obviously overtaxed existing wastewater treatment plans, or more commonly, provided even higher volumes of overall effluent than could be diluted by the same amount of natural flowing dilution rates.

It is difficult to overestimate the negative impacts of the Soviet practices on water use and water resources planning. “Russia’s current environmental problems are first and foremost the result of the economic policy conducted under the system of a centralized planned economy.” (Potravnyi 1997) Given that water had no nominal value, its use was considered to be unlimited and often the least complex solution for cooling, diluting, and other related processes. “The level of water conservation is extraordinarily low.” (Potravnyi 1997) Other entirely non-science-based approaches appear to have had an influence over the role of science in water management. While perhaps not entirely convincing, Wolfson’s comments are telling of the attitudes toward water resources planning: “One of the reasons Moscow was allowed to become so polluted was that the political elite enjoyed protection from a wide range of pollutants. Areas where Politburo members and other high-ranking officials reside – Kuntsevo, the Sparrow Hills, and Fili – used to be kept relatively clean.” (Wolfson 1994) It might be most accurate to assess the Soviet approach to water use as one about which no one gave much if any serious attention for decades.

The results of such intensive water use without proper wastewater treatment are stunning in many cases. In the 1970s and 1980s an intensive increase in effluent levels from industrial activities occurred throughout much of the Soviet Union. (Koronkevich 2003) The resulting levels of water pollution also were destined to grow rapidly. A low-quality of technology of use of water prevailed. Low-volume or no-water technological processes were rarely encouraged. Large amounts of water were used in order to dilute and distance industrial wastes from their source. (Koronkevich 2003) For example, about one third of the source of phosphorous into Lake Ladoga was from Volkhov Aluminum Plant. (Koronkevich 2003) Koronkevich concludes that Lake Onego since the 1960s changed from ultra-oligitrophic to oligotrophic, while Lake Ladoga changed from oligotrophic to mesotropic. One of the results was widespread ground water pollution. “Ground water pollution has been shown at 1,200 locations, of which 80% are in the European part of Russia. Some of the contaminated ground water resources extend over an area of more than 100 km.” (Potravnyi 1997) In spite of the decline in industrial effluent since the beginning of the transition period, that decline has not been sufficient to compensate for the condition of large water bodies, and especially smaller rivers, is still extremely unfavorable. (Koronkevich 2003)

A current Russian textbook for university students, now in its second edition, does not gloss over the severity of the problem: “Neva Bay is polluted with chloro-organic pesticides and concentrations of DDT in the water attain 30/70 mg/l.” (Ushakov 2002) In the region immediately outside of the Gulf of Finland the level of DDT attains 1.1 mg/l. The concentration of heavy metals in the waters of the Gulf of Finland surpasses average concentrations for copper by 10 times, for mercury 5-7 times, for lead 8-10 times, for cadmium 3-4 times, and for zinc 3-4 times.” (Ushakov 2002) Under the economic conditions and demands of the transition period, economic necessities have once again overshadowed environmental considerations in terms of water resources. (Koronkevich 2003). For example, Koronkevich hypothesizes that the defense industry was most affected economically during the 1990s, and they had had the most modern technology as far as water use was concerned. (Koronkevich 2003) Another hypothesis is that equipment aging has been a serious problem in terms of deteriorating wastewater treatment processes. “The most probable reasons [for that deterioration] has been the physical wearing out of equipment at wastewater treatment plants, their falling out of proper adjustment, or into disrepair.” (Koronkevich 2003)

Might some Russian scholars be interested in exaggerating the extent to which water use is mismanaged in Russia? Andrei Parshev has pointed to the “masochism” of Russian scholars to portray environmental issues in Russia to Western audiences. (Parshev 2003) Sergey Lavrov, a former President of the Russian Geographic Society, frequently use the term of "masochism" in regard to environmental problems in Russia. As one Western analyst has concluded in regard to Russian researchers' views of their environmental problems: "They also tended to focus on environmental damages, while ignoring or downplaying more positive environmental practices and conditions in the region. For example, many countries had relatively high levels of recycling and low levels of automobile use." (Carmin 2004) Indeed, a senior researcher at the Institute of Limnology confided to me that the large volume of water from the Neva River so dilutes contaminants from St. Petersburg that alarm over pollution of the Gulf of Finland is exaggerated and that few believe that there are true ecological dangers to the Baltic Sea from St. Petersburg.

A reflection by Goldman on Komarov's critical views, in the preface to one of Komarov's English-language monographs, provides a more moderate evaluation. "… Although there is much that Komarov can justifiably complain about, he does seem to be harsher than necessary. He is most reluctant to acknowledge any progress in coping with the problem. If he mentions any Soviet success, it is normally only to show how the Soviets cover up what is really happening. But this is unfair. While admittedly the Soviets have a long way to go, they have at least come to recognize the problem and are beginning to seek some remedy. Thus, as bad as water pollution may be in most Soviet cities, in many instances the situation is better now than it was a few years ago." (Goldman 1972) While Goldman's optimism perhaps should be more guarded, he does provide an important antidote to Komarov's seemingly relentlessly critical views.

Indeed, comparisons with water resources problems in the United States are not inappropriate, as a recent book by Paul Josephson suggests in terms of the challenges of hydropower construction. (Josephson 2002) Both nations faced similar challenges. "In the aggregate, however, Soviet water pollution seems to be of the same order of magnitude as pollution in the United States, but Soviet pollution is not as pervasive. Vast areas of the far north and Siberia are only very sparsely settled and hence have few pollution-generating activities. Fresh-water flow is also plentiful in these regions." (ZumBrunnen 1978) On the other hand, and unlike the United States, as Peterson notes, "the Soviet government never expended significant resources to counter the rising impact of environmental degradation on drinking water supplies by building more sophisticated purification systems or by piping water from distant, albeit more pristine, sources." (Peterson, Chap 3, p. 82) Challenges will inevitably remain. "In other words, by treating natural resources as free commodities, the Soviet planners and decision makers experience great difficulties in trying to internalize social costs into the planning and day-to-day operations of their economy. Unfortunately, the U.S. experience is quite similar." (ZumBrunnen 1974)

A continuing problem of aggregation of data

Evaluations inevitably have focused on a number of the more catastrophic situations concerning water resources in the former Soviet Union. The continuing dessication of the Aral Sea, the falling and now rising Black Sea, and nuclear dumping at sea have typically attracted the most attention. Murray Feshbach's work in particular has publicized such blanket characterizations of water resources. (Feshbach 1992; Feshbach 1995) One might extrapolate from such issues that all of the water resources of the former Soviet Union are in trouble. "As a result, it has helped propagate the belief that Lake Baikal is seriously polluted at present. Yet simple arithmetic reveals the fallacy of this interpretation." (ZumBrunnen 1978) His research concluded that Lake Baikal's incredible volume indeed provides for a large-scale dilution source.

The challenges to investigating water pollution problems in the transition economies are significant. As one OECD report has concluded about the Newly Independent States, "Quantifying the water pollution problems in the NIS is not easy – few countries have fully operational national water quality monitoring programmes, and so water quality and pollution data tend to be project-specific and anecdotal in nature." (OECD 2001) Another Western agency report concludes that water pollution is even more challenging to investigate than air pollution in the transition economies. "It is even more difficult to obtain consistent data on emissions of water pollutants and on ambient water quality than for air pollution and ambient air quality.

This is especially true for large cities where ambient air quality data are more readily available than data on rivers which pass through them." (Hughes 1999)

One of the most troublesome and deeply engrained problems of previous research has been the reliance on highly aggregated numbers in evaluating environmental disruptions in Russia. Russian statistical publications have propagated this problem by reporting in highly aggregated units. Pollution amounts are commonly reported at the administrative subject level. Even the most recent Russian research has relied on very large data aggregates. (Koronkevich 2003) This problem has long-time origins, as statistical agencies during the Soviet period published data exclusively in very large aggregates. That practice of statistical agencies continues today. The imprecision involved in using such large aggregates, usually at the large regional level, has drawn criticism in the past. "The obligatory use of regional rather than point-source raw data, however, also obscures many serious Soviet water-quality problems which exist on a smaller or local scale." (ZumBrunnen 1978) Point-source raw data are difficult to acquire today, but are available. ZumBrunnen recognized the challenge of evaluating water resources during the Soviet period without raw data: "An attempt to present a comprehensive view of the actual magnitude of the Soviet Union's current water-quality problems poses, therefore an impossible task." (ZumBrunnen 1978).

Surface water and drinking water quality inevitably vary widely depending on exact location, and as we will see, can vary widely within a single urban area. "Water quality depends greatly on local infrastructure, which has deteriorated in the economically hard-hit NIS." (Hughes 1999) The challenge of extrapolating findings to larger overall trends is a challenge that remains. "Identifying overall trends of water quality can be difficult as these are often linked to local factors. As a result, data on water quality are limited and of uncertain reliability." (Hughes 1999) For example, ZumBrunnen has pointed to the challenge of aggregated data sources for study of the Volga River and Caspian Sea in one of his studies. "Contaminated zones along the Volga River and the Caspian Sea and the locally polluted lakes and rivers of Northwest European Russia also are hardly visible at the regional scale used in this study." (ZumBrunnen 1978)

Attempts to characterize a single region or a single urban area also face challenges. For example, the statistics for conveyance loss, the amount of drinking water lost during transport through pipes can vary widely within the piping network of a single water authority. "Values for losses vary across a wide range for individual cities, regions, and countries." (Shiklomanov 2003) For Russia, he estimates that losses for urban public services are "presently estimated to be between 15% and 20%, but over a large basin they may be from 10% to 30%." (Shiklomanov 2003) Similarly, water quality monitoring results can vary significantly for a single water body depending on water flows and proximity to polluting sources. Much of the complexity of the topic is further aggravated by an absence of widespread monitoring throughout a region or city. Again, monitoring in the transition economies faces financial problems. "Our research on secondary pollution is proceeding very slowly. We do not have the means." (Komarov 1980)

Another investigatory challenge comes in the way that water quality data have been collected. "The lack of reliable data on water quality is in part an issue of reporting, especially in the NIS. The successors of the Soviet State Committee on Meteorology and Hydrology (known as Hydro-Met) continue to collect and analyze water samples for many sampling points all over the NIS. However, sampling frequencies are erratic and most of the results are kept in the form of paper records which are easily lost or can only be compiled with a considerable effort." (Hughes 1999) While data are increasingly stored in electronic records, sampling data sets have had interruptions. Even St. Petersburg, a relatively well-funded research target, experienced a year without data collection in 1999, after more than three decades of data collection.

Some of the data aggregation approaches practiced in the former Soviet Union are unusual by Western standards. "Most NIS countries continue the former Soviet practice of recording the total volume of wastewater discharged with separate figures for wastewater that is discharged with and without some form of treatment." (Hughes 1999). Given the large amount of wastewater that is discharged without any form of treatment, there may be some advantages to the Soviet methodological practices. Nevertheless, it appears that the Soviet approach was based at least part in a sampling approach. Not all industrial pollution data were included in data sets. "Some regional environmental agencies compile data on discharges of BOD, metals, and other pollutants but – like the wastewater discharge data – this seems to be based on

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information supplied by large industrial plants, which usually account for no more than 20-30 percent of all discharges." (Hughes 1999).

Other issues remain concerning aggregation and data collection approaches in the former Soviet Union. The use of national maximum allowable concentrations at a regional level that do not taking into account local factors and background levels. (Sorokin 2004) Those maximum allowable concentration levels are closely integrated into water quality data, as the data are based on a water quality index system based directly on the extent to which those allowable concentration levels are surpassed (the *vodkhoz* or so-called 2-TP system). Other pollution amounts are not collected at all. Research into surface runoff in urban environments has been a particular challenge that is largely unaddressed in data sets in Russia today. Despite the desire to determine water resources at a highly disaggregated level, national and regional comparisons of degrees of water resource deterioration are nonetheless inevitable. In the face of limited funds, policy-makers seek guidance in terms of evaluating water-related environmental problems and determining those nations and regions where resources are best spent.

Decomposing the role of economic change

One of the central goals of this investigation is to determine the extent to which the full range of socio-economic drivers in the case of trends in water resources can be decomposed into its separate parts. Views differ widely as to how economic transition affects water resources and its planning. Some have emphasized the extent to which residential waste represents a very significant portion of urban water pollution sources. "Most water pollution is highly localized and is often linked to discharges of human wastes rather than to industrial or other economic activities." (Hughes 1999) Others suggest that a large extent of water use is discretionary and that socio-economic changes might have a critical effect even on residential water resources and its use.

Few doubt that the transition period's impact on water resources has been substantial. As a recent Russian monograph on water resources in Russia observes: "Those current transformations of natural water sources in the post-Soviet space, including Russia, are developing to a large degree by unpredictable scenarios and pose a whole series of questions for hydrologists. This is, foremost, a result of those political and social-economic changes that have seized the territory of the former Soviet Union and Eastern Europe." (Koronkevich 2003) Urban planning is one realm that has been very profoundly transformed by the transition period. Yet little attention has yet been paid to infrastructural issues and longer-term planning in the transition economies. "Arrangements regarding municipal finance and infrastructure that affect investments in and the operation of sewerage and wastewater treatment systems are at least as important as economic restructuring." (Hughes 1999)

Socio-economic examinations of the transition period (1989 – present) for countries of the former Soviet Union and Eastern Europe have only rarely addressed environmental concerns and issues in direct reference to economic change. Change has been so rapid that most attention has focused on macro-economic indicators. In an otherwise comprehensive World Bank report on the transition, *Transition: The First Ten Years* (2002), a discussion of environmental issues was almost altogether absent. Yet socio-economic change have had more of an influence on urban environmental conditions in the transition economies than any other factor. Water pollution changes range from significant changes in effluent amount, to changes in wastewater treatment practices, to changes in both measurements of those effluents and economic change.

The role of environmental protection institutions and their management of natural resources is another subject of this investigation. Baker and Jehlicka argue for Eastern European countries that "there have been positive improvements in the quality of the environment, which have arisen directly as a result of new environmental policies put in place after 1989." (Baker 1998) Institutional approaches to managing water resources have changed rapidly. Since 1991 charges have been levied for exceeding legal limits pollution and for the use of natural resources in the Russian Federation. These charges are intended to provide an economic stimulus for reducing pollution levels and for sparing use of natural resources. (Potravnyi 1997) Of course the importance of other forms of environmental impacts have also likely emerged, most notably in terms of urban surface runoff for water pollution. New institutional approaches have in some cases, but not also always, sought to address those new concerns. The rate of institutional change, often coupled with institutional inertia, has been staggering. (ZumBrunnen and Trumbull 2000) Only a single report by a Western agency, the OECD, has begun to address on this issue as concerns water resources planning in the Newly Independent States region in a report that largely focuses on Central Asia. (OECD 2001)

It is widely accepted that water use has fallen less than macroeconomic indicators in the transition economies. One study has found that there has been a fall in the proportion of the highest-tech and most water-saving industries and a relative increase in the most water-intense sectors of electro-energy. (Koronkevich 2003) Examination of amounts of pollution per economic unit have been illuminating. Calculations of pollution intensity have indeed proven to be one of the preferred approaches for calculating the environmental impact of economic transition. (Peterson 2001; Oldfield 1999; Crotty 2002) Yet those studies have typically used geographically highly aggregated data, most frequently on a national scale. This study focuses on more disaggregated data at the level of a single city, and in some cases, on single water bodies within the urban environment of St. Petersburg.

St. Petersburg as study site of water resources planning in the transition economies

The specificity of St. Petersburg and its adjacent and surrounding water resources as a case study deserves more extended explanation. The Gulf of Finland and Baltic Sea are very shallow and the effects of urban runoff and other pollution sources are even more serious than for other water bodies of similar size. Comparisons with the equally very shallow Chesapeake Bay are instructive. (Horton 2003). The city is blessed by a surplus of water year-round. This is in contrast to many other parts of Russia. The high-volume and high-current Neva River serves a number of critical roles in terms of water resources for the city.

The city's drinking and industry depends almost exclusively on the Neva River for water delivery. Evaluations on the quality of that water range widely. "The Neva River, which flows through the city, is polluted by upstream timber processing factories around Lake Ladoga. This in turn causes the city's water supply to be unhealthy and at times undrinkable." (Pryde 1995) Like most water sources, the quality of the city's water in fact depends highly on the season of the year and other more localized storm events that affect Lake Ladoga and the Neva River. That high variability of water quality will not likely change soon, and even the long-term plan to withdraw water directly from Lake Ladoga and transport it by conduit to St. Petersburg will not fully solve that problem. Lake Ladoga's own water quality varies highly depending on wind and thermocline conditions that affect overall mixing. On the other hand, the high volume and rapid current of the Neva River has served the city well for centuries as wastewater has in effect been flushed from the city by natural means. The city does not have a divided sewer and street drainage system, there is only a single set of pipes. As this study will explore, a very large amount of the city's wastewater is entirely untreated and goes directly into Neva Bay.

In terms of the city's economic base, the city was traditionally a site of a high concentration of industrial activity in order to drive the city's military-targetted industries. (Bater 1976) Some estimates indicate that military-oriented industries reach as high as two-thirds of the city's economy during the late Soviet period. Those industries were intensive polluters by the nature of their production, especially as concerns heavy metals and other highly pernicious effluent. Those manufacturers may at the same time have had a higher chance of using technologies for cleaning that other plants would likely not have used. Further, it was precisely the military-industrial complex whose funding has been subject to highly variable funding during the transition period, first falling dramatically and receiving renewed government contracts in more recent years. Some of that industry was also able to engage in conversion activities rather successfully, due in large part to a highly technically trained workforce.

Given the city's geographic proximity to Western nations, the city's water resources and especially wastewater have come to the special attention of Western nations whose populations live in the immediate vicinity. This Western scrutiny of water resources is more focused on St. Petersburg than likely on any other city of the former Soviet Union. The city's Vodokanal has been wealthy enough to pay for chlorine concentrations in largely sufficient amounts. Vodokanal has also been able to advance relatively rapidly in completing construction on the city's three major wastewater treatment plants. One might indeed contrast St. Petersburg's relative advantageous economic conditions with a conclusion drawn for Russia as a whole: "Technological modernization and the transition to environmentally clean production processes, as well as the construction of effective clean-up facilities at major polluting plants, management of material inputs in production all require considerable investment, and therefore hardly be implemented at the moment, considering the general dearth of finance." (Potravyni 1997) Yet as a result of its relative wealth, and with the exception of Moscow, St. Petersburg leads other cities in Russia in terms of investment levels in its wastewater treatment plants. In this sense, St. Petersburg is in an exceptional position in terms of being able to set an example for other urban environments in the former Soviet Union.

The city has also been progressive in terms of its planning. It was the first to design and make public a city strategic plan in post-Soviet Russia. (Trumbull 2003) The city's Vodokanal has published a number of highly detailed ecological report on its activities. As we will see, Western investment in the city's wastewater treatment plant has served a positive role in encouraging Vodokanal to make such information available. The city has been able to employ a number of new Western technologies that would be the envy of most urban centers of the world; they include light-based water decontamination, new lining of existing water mains without removing the water mains, and a solid waste incineration plant. A recently completed city Museum of Water is unique in its size and quality in the former Soviet Union. Other aspects of Vodokanal's activities remain largely opaque and without transparency to the public.

Other aspects of the city make it as common as any other city in the former Soviet Union. The use of water is almost without exception unmetered in residential units. Costs are extremely low by Western standards (17 rubles for cubic meters for cold water; 24 rubles for cubic meters for hot, according to March 2005 prices, author). Water conservation appears to be rarely a consideration for industry as well as for city residents. A large amount of the city's delivered water is lost in transport to the end users. Vodokanal estimates conveyance loss to be about 20% of total water delivered. This number is high, but in line with many older Western cities. The fact that such conveyance loss exists also suggests a positive water pressure throughout much of the system; such pressure plays a critical role in reducing contamination of the water.

Other new impacts on water resources in the city will continue to evolve rapidly in the coming years. The level of water transport has been increasing very rapidly, due to booming Russian exports of oil and timbers, has added to the risk, and already a few incidents, of spills. The city's numbers of privately owned automobiles has boomed, as throughout much of the former Soviet Union, and issues of urban runoff are critical. A housing boom is creating more long-term residential demand on water use, as more consumer appliances are bought. The city's anti-flooding dam construction, stalled for almost two decades, is developing at a much more rapid rate. The dam's overall effect remains highly controversial. Others have heralded the dam's completion, which few now doubt will occur by the end of the decade, as an opportunity to reduce the city's traffic from the city's center.

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